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SURVEYING IN CHICAGO.

(II.)

One of the "stock" questions which a Chicago surveyor has to answer is "How much surplus have I on my lot?" and the expectations of clients run from one inch to several feet. The principal occasion of this is the inaccuracy of the standards by which the surveys were tested in the early history of the city. Many subdivisions were made with a chain that was about three inches in sixty feet too long, and this state of things continued until 1847, when the City Council sent Asa F. Bradley, county surveyor, who is now perhaps the oldest practising surveyor in Cook County), to Detroit, then Government headquarters for the West, to procure a correct U. S. standard. Mr. Bradley brought back with him a three feet brass standard, which was used as a test by City and County surveyors until the fire of October, 1871, swept away it and all the places where the several surveyors had their standard tests laid down. In the present apology for a City Hall, which was built immediately after the great fire, a standard was laid down by the Board of Public Works, by simply taking a new steel chain of a well known eastern manufacture and, stretching it taut, driving a small brass nail at each end and at every ten feet. The chain used almost universally in Chicago is a fifty feet patent Grumman chain, and it happened, in this particular case, in the adjustment of one of the handles, that the chain was left too long by half an inch, the excess all falling on one end of the chain. By it the city engineers have made their measurements, and it has also been used by several city surveyors as a standard. Where *pro rata* division of property was made there was little cause for disagreement, but in cases of "metes and bounds," and where certain lines were established by city ordinance at a certain number of feet from some other established line the difference between the measurement by different surveys at once became apparent and became a source of considerable annoyance. That standard is still in use and is but one evidence of the loose method of doing things in our go-ahead city. The surveyors who cared to be more accurate laid down standards for themselves. But lately, Alex. Wolcott, Esq., County Surveyor, feeling the necessity for a reliable standard of measurement, procured from the office of the U. S. Coast Survey, at Washington, two steel rods which were accompanied by the following certificate:

U. S. COAST SURVEY OFFICE,
WASHINGTON, AUG. 10, 1874.

"Memorandum relative to two steel rods of 6 feet length sent to Alex. Wolcott, Esq., *City* Surveyor of Chicago, for the City of Chicago.

The rod marked No 1 is equal to 72 standard inches at 63° Fahr.; the rod marked No. 2 is equal to 72 standard inches at 56.5° Fahr. The expansion of each is 0.00045 in. for each 1° of Fahr. No. 1 is shorter than No. 2 by $\frac{29}{10,000}$ of one inch; at 59¼° Fahr., the two together are equal to four standard yards. The rods should be laid free to move in a V shaped groove on wooden bars."

J. E. HELGARD,
Inspector of U. S. Standards.

By means of these standard rods there may be laid down in a convenient place a test by which all the surveyors and engineers of the City may compare their chains, and this should be done at once by the city authorities, and then, in cases of disputed surveys the measurements can be referred to this test.

RULE FOR THE CORRECTION OF THE COURSE OF RANDOM LINES.— $A = 206265'' \times \frac{a}{r}$ is an equation in which A= the number of seconds in an angle subtended by an arc a of a circle whose radius is r; and any two of these quantities being given the third may be calculated by the given equation. On account of a being very small compared with r, it may be considered and treated as a tangent. This rule may be illustrated by the following example: A random line running from the quarter post on the north line of a section, with a variation of 7° E. intersects the south line of the section at a distance of 25 links to the west of the quarter post; what is the variation on which to run back a true line from quarter post to quarter post, the length of the quarter line being 8012 links? Here $a=25$, $r=8012$, and A, the required correction $=10'\ 43.6''$; then the true variation is $7°\ 10'\ 43.6''$. This rule is applicable to all cases in which the arc is small.

The City of Chicago has a length north and south of 7 miles, and average width of 5½ miles with the exception of the part north of North Ave., which is but 3 miles in width, making a total of about 22,240 acres.

FOUNDATIONS.

(CONCLUDED.)

A trial round pile of 20 inches diameter at the butt, and 13 inches at the small end, of 49 feet in length, was driven by a 2,024 lbs. hammer, falling finally 35 to 45 feet below the foundations. The first 100 blows the hammer fell but a few inches; the next 260 blows drove the pile 30 inches in 46 minutes; the next 260 blows drove the pile ½″ to 1½″ per blow for 60 minutes; the next 110 blows averaged 1¼″ per blow for 60 minutes, the hammer falling the last blow 34 feet. This trial pile subsequently received 200 blows, through the medium of a follower, which drove it an average of ½″ to each blow. Another trial pile was driven 41 feet by a Nasmyth steam pile-driver, and then another pile 15 feet long driven on top of the first, making a total penetration in the earth of 57 feet. The first pile was driven 42 feet by 373 blows, in 7 minutes, and the second pile was driven 15 feet by 2,400 blows, in 43 minutes; the movement of these piles indicated the continuance of the same material to the depth which they reached.

The foundation was mostly laid as follows: The excavation being completed to the proper depth, and piles cut off to an uniform level, 2 feet of concrete was rammed between the bearing piles. These piles were then capped with 12 and 14 inch yellow pile timber laid transversely with the axis of the dock, and trenailed to each pile. The concrete was then raised to the top of these timbers, and a light flooring of 3 inch yellow pine plank was laid upon and spiked thereon. Another course of similar timber was then placed upon this floor, breaking joints with those below, to which they were tre-nailed. The intervals were next filled with concrete, and another floor of 3 inch plank spiked down, which completed the foundation.

The amount of work done by the heavy Nasmyth hammer was at least ⅓ greater than that done by those whose hammers were only ½ the weight. This Nasmyth hammer of 4,500 lbs. was worked with very short rapid blows, raised a height equal only to the stroke of the engine. The support of this foundation is derived mainly from the adhesion of the material into which the piles were driven, and slightly from their sectional area. It was ascertained that it required a weight of 125 tons to draw up one of these piles, or rather to start and put it in motion, when driven 33 ft., to the point of ultimate resistance, with a ram of one ton falling 30 feet at the last blow. The piles averaged 12 inches in diameter in the middle, making at least a support of 100 tons per square foot of foundation.

The first difficulty encountered in building the High Level Bridge at Newcastle, was in securing a solid foundation for the piers. The dimensions of the piles to be driven were so huge that the engineer found it necessary to employ some extraordinary means for the purpose. He called Nasmyth's Titanic steam hammer to his aid—the first occasion, we believe, on which this prodigious power was employed in bridge pile driving. A temporary staging was erected for the steam-engine and hammer apparatus, which rested on two keels. Notwithstanding the newness and stiffness of the machinery, the first pile was driven, on the 6th of October, 1846, to a depth of 32 feet in 4 minutes. Two hammers of 30 cwt. each, were kept in regular use, making from 60 to 70 strokes per minute, and the results were astounding to those who had been accustomed to the old style of pile driving, by means of the ordinary pile frame, consisting of slide, ram, and monkey. By the old system the pile was driven by a comparatively small mass of iron descending with great velocity from a considerable height—the velocity being in excess and the mass deficient, and calculated like the momentum of a cannon-ball, rather for destructive than impulsive action. In the case of the steam pile-driver, on the contrary, the whole weight of a heavy mass is delivered rapidly upon a driving block of several tons weight, placed directly over the head of the pile, the weight never ceasing, and the blows being repeated at the rate of a blow per second, until the pile is driven home. By the aid of this formidable machine, what before was among the most costly and tedious of engineering operations, was rendered simple, easy, and economical.

In the construction of a bridge on the Railway from Amsterdam to Rotterdam, the heads of the piles were cut below the water line, by a simple apparatus, consisting of a deal box well put together and caulked, so as to be water-tight; it was 6 feet 6 inches long, 4 feet 3 inches wide, and 3 feet 3 inches deep. Through the centre of the bottom there was a hole large enough to admit the head of a pile. Around this hole was nailed the open bottom of a sack of stout canvas, strengthened with leather; two cords were made fast, by one end of each, to the box, and the others were passed through pullies in the sides.

When a pile was to be cut off, the box was put over it, and by weights within, it was caused to descend as low as was requisite; by means of the two cords the lower end of the sack was then drawn round the pile so as to form a water-tight joint; by a small pump the water was then emptied from the box, into which a workman descended, turned back the canvas sack, and after sawing off the pile, cut the head into any desired form.

This system is stated to have been used wherever the piles were to be cut off under water, and to have been very successful.

In the Washington street tunnel, the lengths of 24 piles varied from 35 to 40 feet, the average length being 37¾ feet; time of driving same varied from 7 to 45 minutes, the average being 15 1-6 minutes; the number of blows required for each pile varied from 8 to 88, the average being 20 1-6; depth driven into the clay varied from 20 to 30 feet, the average being 21½ feet; weight of hammer used 2,300 lbs.

In another set of 15 piles driven on the same work, the lengths of the piles varied from 30 to 45 feet, the average being 38⅜ feet; number of blows required to each pile were from 10 to 72, the average being 30 7-15; time required for driving each, from 6 to 60 minutes.

Mr. Cregier found in excavating for and sinking the crib for the new pump well to a depth of 25 feet below the surface, that the greater portion was through quick sand, and of a very troublesome character, the clay being 15 feet below the surface. In his report he says:

"The clay is 15 feet below the surface in this locality. "Just before reaching it there is a thin stratum of "hardpan, which is exceedingly hard to excavate. Just

"at this point an obstacle was met with which caused "some delay and considerable trouble to remove; it "proved to be a log of wood, nine feet long and one "foot in diameter; it was found directly under the "curb, lying in an oblique direction, completely ob- "structing its further descent. The dredge was brought "to bear upon it, and excavation was made far below "it. This caused a slight caving of sand from the out- "side. The water inside being 13 feet deep, a portion "was pumped out, and the obstruction finally removed. "The excavation was resumed, and after removing the "stratum of hardpan, the fine blue clay was reached, "the iron shoe sinking in it making a partial joint, "thereby excluding the flow of water from the outside. "All the water was then pumped out, and the labor of "sinking the curb from this point to the required depth "was attended with comparatively little danger or dif- "ficulty."

Mr. Chesbrough, in his report on the Lake Tunnel, says:

"The excavation was generally through stiff blue "clay, but with the irregularities of character peculiar "to the drift; it very seldom required bracing when "not left to support itself for more than 36 hours. "Sometimes sand pockets were met, and when these "were over the upper arch, they would empty them- "selves partly, leaving cavities to be filled with ma- "sonry, but these were seldom of much importance. "Sometimes small bodies of quicksand were encount- "ered, but they occurred only in pockets, and not in "strata, and therefore gave no serious trouble. Some- "times the clay would be soft enough for a miner to "run his arm through it, but with the exception of re- "quiring a little more 'trimming' for the masonry, this "gave no trouble. Sometimes boulders, weighing sev- "eral hundred pounds, were met, and interfered a little "with the regular progress of the work, but seldom "more than a little. The greatest and most dangerous "difficulty met with, was one that was not anticipated "at first, and that was inflammable and explosive gas. "Early in the progress of the work several accidents "occurred from this cause, but fortunately without "fatal results to the workmen, though there were sev- "eral narrow escapes. Very soon the miners learned "to detect the proximity of cavities containing the "gas from the sound produced by striking over them "with their picks. When a cavity was thus detected, "it was bored into with a small augur, and the gas "ignited as soon as it began to escape. In this way "explosions were prevented, which otherwise took place "when large bodies of gas were suddenly allowed to "mix with the air. The explosions that did occur were "slight in character, but left a body of flame in the "upper part of the tunnel. At such times the miners "fell with their faces to the ground, and thus escaped "without any greater injury than singed beards and "eyelashes, and blistered faces, except in the first se- "vere case, when a miner was badly burnt. At this "time the gas kept the miners out of the tunnel for "three days."

In the excavation for the Washington street tunnel, and in the LaSalle street one, we examined the clay repeatedly, and found that all below the depth of about 33 feet from the original surface, is of a compact and reliable character for permanent work. We met with only two or three boulders in the whole work on Washington street, but sand pockets quite frequently on both works.

The following are the results of Capt. A. S. Bergh's borings, under Mr. Chesbrough, Chicago, Oct. 30, 1868:

SOUTH DIVISION, *S. W. cor. State and 22d Streets.*—Quicksand to 16 feet, from 16 to 29 feet very good clay, from 29 to 60 feet, mud. In boring here, by putting weight on the auger, it would sink 3″ to a turn. In clay the auger will not go faster than the screw will naturally draw it.

22d St. cor. Stewart Ave.—Sand to 12 feet, from 12 to 50 feet hard clay, struck a boulder, moved a hundred feet further west and found hard clay from 12 to 60 feet.

Clark, near 22nd St.—The ground here is about the same as the cor. of State and 22d St. A man living near reported that in digging a well he found shells at 32 feet, and in considerable quantities.

Clark, cor. 23rd St.—Quick sand to 14 feet, from 14 to 42 feet soft clay, from 42 to 46 feet clay mixed with gravel, from 46 to 60 feet, mud.

Clark, cor. 16th St.—Soft clay to 57 ft. 4 in., where we struck rock; 2d boring, soft clay to 57 ft., then rock

Calumet Ave. and 22d St.—Sand to 30 ft., from 30 to 60 ft. soft clay mixed with gravel.

4th Ave. and 12th St.—Black loam to 6 ft., from 6 to 32 ft., clay, occasionally mixed with gravel; from 32 to 60 feet, very good clay.

Polk, on alley between 3rd and 4th Ave.—Loam to 13 ft.; from 13 to 32 ft., hard clay; from 32 to 36 ft., a stratum of sand; from 36 to 50, hard clay. I then got into hardpan, which finally became so hard that the auger would not penetrate it.

16th Street, near the Lake.—Sand to 16 ft.; from 16 to 36 ft., sand mixed with gravel; from 36 to 56 ft., sand; from 56 to 61, coarse gravel.

12th Street, near the Lake.—Sand to 12 ft.; from 12 to 23 ft., gravel; from 23 to 54 ft., soft clay; from 54 to 60 ft., good hard clay.

Quincy, corner Market St.—The clay here is uniform from 18 to 60 ft., it is blue, consistent, but not hard; struck at 62 ft.

Madison, corner Franklin.—The ground here is the same as the last.

NORTH DIVISION.—*N. Water, between Dearborn and Clark.*—Soft clay to 26 ft.; from 26 to 55 ft., very good clay; from 55 to 60 ft., very hard and stiff clay.

WEST DIVISION.—*English, corner Throop St.*—Soft clay to 33 ft.; from 33 to 55 ft. it is very hard and dry.

Morgan, corner 22d St.—Rock at 30 ft., bored in four places, and found rock at the same depth in each.

Nutt, corner Morgan St.—The clay is very stiff and dry, breaking the auger three times in getting down to 56 ft.

16th, corner Halsted St.—The clay is of the same nature as on the corner of Nutt and Morgan to the depth of 44 ft., when I struck rock; made four trials at different places with the same result in each.

Munn & Scott's North Elevator.—Good clay to 42 ft., then Rock.

12th, corner Halsted St.—Clay rather soft to 42 ft.; from 42 to 67 ft. the clay is hard and dry.

12th, corner Clinton St.—The clay is very hard and dry to 55 ft., when the augur broke, and I lost 27 ft. of the rods.

Clinton, corner of Harrison St.—The clay is somewhat soft and mixed with sand to 40 ft.; from 40 to 61 ft. the clay is hard and dry.

Harrison, corner of Loomis St.—The clay is very hard; broke the auger three times in getting down to 58 ft.

Reuben, corner North St.—Struck rock at 8 ft.; the rock crops to the top of the ground in several places in the vicinity.

Blue Island Ave., corner Harrison St.—The clay is somewhat soft to 50 ft.; from 50 to 60 ft. it is hard and dry.

East side of Canal, bet. Harrison and Van Buren Sts.—Clay is soft to 43 ft.; from 43 to 47 ft., clay mixed with gravel; from 47 to 60, clay hard and dry.

RECLAMATION OF TULE LAND IN CALIFORNIA.

The following interesting account of a proposed reclamation of swamp lands in California, is a communication to the *Mining and Scientific Press* of San Francisco, from T. R. Scowden, C. E., one of the Engineers who examined the district.

The examination of the swamp land, District No. 107, which we were directed to make, was commenced at a dam thrown across the mouth of Rocky slough, near the shore of Old river, and extended along the bank of the river to Indian slough, thence along Indian slough to the upland. We instituted a series of borings, at intervals, along the whole route, some taken inland, but mostly at the bank of the river.

As the borings progressed, soundings with a lead were taken at distances of 20 to 50 feet from the shore, to determine the depth of the river and ascertain the character and quantity of material that could be obtained from the source for levee purposes.

The details of these examinations, illustrated with diagrams and cross sections, together with explanatory field notes, accompany our report, but are omitted here.

The brown peaty and spongy surface, peculiar to low tule lands, was found to average along the bank of the river about seven feet in thickness, forming a tenacious, elastic crust, composed of tough tule roots and interlaced fibrous matter, with a slight admixture of sediment and vegetable mould, gradually softening downward until it becomes almost semi-fluid st the bottom. Where the peaty crust ends, an under stratum of the consistency of an ordinary mud bar begins. This formation, extending from the river bed inland, gradually hardens downward until tough blue clay, resting on hard pan (so-called) is reached, the depth varying from 15 to 24 feet from the surface of the land. The composition of this formation is principally clay and very fine sand, with a slight admixture of mica and sulphuret of iron, the proportions slightly varying at each boring. This material has not the solid consistency necessary to make a levee of, but combined with the tough, peaty surface, is admirably adapted to the purpose.

The examinations made by inspection and boring satisfied us that the general character of tule lands bordering on the San Joaquin river and its branches, as he described, were identical. This peculiar formation, marvelously fertile, commencing at nothing at the upland, was found to attain the greatest depth, some 30 feet to hard pan, along the banks of the main river.

We did not chain the distance from point to point where the borings were made, but we selected those places which indicated soft formation and treacherous foundations for building a levee upon, and which had caused the greatest trouble and expense from breaks and keeping the levee in repair, and there made the tests with the greatest care.

This we did to satisfy ourselves with regard to the practicability of building a substantial and permanent levee upon the worst places, and at reasonable cost, with the material at hand. Of this, there is in our minds no question, at a cost not to exceed $3,500 per mile (there being 26½ miles extent of levee), nor more than $10 per acre (there being about 17,126 acres) assessment on the land within the district, to cover cost of canal from Point of Timber to Dutch slough, as well as catch-water to collect and carry off the rain fall from the uplands, flood-gates, repairs, ditches, drain and all.

The sedimentary deposit or mud bars, which will be be used in part as material to build the levee of the plan proposed and heretofore explained, will be found along the shore.

The brown, spongy, light and peaty material, of which the present line is built, is found unsuitable to the purpose. It shrinks to that degree, when dry, as to leave fissures or cracks in the top of the levee from two to two and a half inches wide per lineal yard, which not only pass water, during high tide, from the river to the land, but destroy cohesion and lateral stability of the structure, as well as its power resistance to hydrostatic pressure, and permanence.

To this cause, all the breaks in the present levee, inundations of the land, destruction of crops, and pecuniary loss to owners, so lately experienced and severely felt, are attributable.

From these investigations, carefully made by the surveying party, consisting of General Sherman Day, T. R. Scowden, Captain J. A. Welch, J. C. Stump and others, it was apparent to all, that the present levee is not only badly built, but is improperly located some 90 feet from the river shore, on soft and yielding ground. It was found by the borings that the peaty formation, overlying the clayey material and hard pan (so-called), was greater inland than near the river bank, the only place where a levee, on tule land can be safely located. As to the method of building a levee properly located and constructed, which we believe can be done, we would recommend this. In all cases the work shall be preceeded by careful boring, to ascertain the depth of the peaty formation, and whether any subterraneous passages which do sometimes occur, underlie the surface, forming a crust of varying thickness, called float land of sufficient strength to support cattle, and even the levees. In front of Captain Lockhart's ranch, the sounding rod, while boring, dropped five feet from the bottom of the float land to the top of the soft earth stratum beneath.

The next step should be to stake off the base lines of the levee 30 feet apart and 25 feet from the outside line to the brow of the river bank. Tracing out these base lines, an incision with a sharp tule knife some four feet long, through the tough surface, down to the less tenacious and and soft material below, ought to be made, to completely detach this continuous belt from the adjacent surface of land, as a foundation upon which the levee will be built. The work of building this levee will be commenced by coating the surface of this belt with plastic material, taken from the river bed with a dredge, and deposited in place, thus forming a bed, as it were, of mortar. Upon this bed of mortar a course of peaty material, taken from the adjoining drain and the present levee (by utilizing which a great obstacle and an ugly feature will be removed from the land), will be laid and well grouted with the semi-fluid substance, dredged from the river so that every crack or interstice shall be filled. The manner of doing the work, will be similar to the construction of a wall of rubble-masonry, built up in courses with full beds of mortar, grouted

in every course. As the levee or wall, composed of impervious and peaty material, is carried up, on this detached belt, described above, the levee from the superincumbent weight or load, will slide downward in the groove, made in the land by the sinking of the detached belt, lubricated by water, until the whole mass settles and rests permanently on the sub-stratum below. The flexibility of the levee, from its composition of peaty substance and plastic material, will adapt itself to the undulations of the earthly substratum, and thus form, when in place, a perfectly impervious barrier to the ingress of water, from the river and tides, whether above or below the surface of the land. And we hold that the water wall standing alone, independent and detached as it will be, will stop land-cracks, that often occur, to the full depth of the peaty formation, varying from seven to 25 feet, as for instance in Twitchell Island, where a crack opened a wide channel to the river, letting in the water, and flooding the land.

The foundation of this levee will differ from the one built in the usual way, inasmuch as the base of the latter rests on the surface of the ground, on which, when the tide is high, the hydrostatic pressure is great, by virtue of the force exerted against it, and the seepage and currents of water under it, which first lifts and lubricates, then slides, and breaks the levee and floods the land. Whereas the former (the levee proposed) will have its base two feet below the surface of the land, and is thus supported by a shoulder or prop of earth behind it, which prevents sliding, and gives the levee statical resistance that will render it solid and immovable.

It will be necessary during the progress of the work, and from time to time after the levee is completed, to keep the top at a true level.

The dimensions of the old levee are 12 feet base, on the ground level, 3 feet wide on the top, and 3 ft. 6 in. high. The dimensions of the finished levee at the base will be the full width of the peaty 30-foot belt, six feet wide at the top and six feet high from the ground surface, with slopes two horizontal to one perpendicular. It is assumed from what is known of other levees, as for instance that of Sherman Island, the best example on peaty land, Grand Island being the best found on sedimentary land, that the levee under consideration will settle on an average two feet, the point at which the levee slopes will begin; this will give 12 square yards area of cross section above the surface, and 6.66 square yards below the surface, or 32,841 cubic yards per mile. What number of cubic yards will settle below the surface, in a very soft ground, or at subterraneous places, which bear a small proportion to the whole, can only be determined by practical experience. The same may be said of the dredging from the river, and depositing the plastic or grouting material on the levee Enough, however, is ascertained from estimates made by reliable parties, willing to contract for the doing and completing the work in accordance with the plan described, to judge with a great degree of certainty, that the cost of labor and dredging will not exceed 10 cents per cubic yard.

The pertinent query will naturally arise in the minds of many, why the material from the river alone, raised by the dredge and deposited on the foundation belt, without the admixture of peaty substance, would not answer as well or better than the method proposed? The answer is:

First—That the peaty material in a levee will not be cut by the passage of water over it, while clayey material cuts rapidly. The two combined however, we think, will answer a better purpose than either alone.

Second—That the material found in the bed of Old river, which will be used for levee building, is, for many feet in depth—in fact, to the thin stratum and blue clay overlying the so-called hard pan—of such a pasty and semi-fluid consistency that, when dropped by the dredge into place, it would flow or run like mortar. If time could be taken, which would be considerable, and doubtful as to the extent, to dry the material, with the daily action of the tides upon it, the thing might with great difficulty and at heavy expense be done; but when done, it would probably be little if any better than a levee made by the plan here recommended. Besides it will hardly be claimed that the portion of the clayey levee which settles under the tide-level and land surface, while being built,—to say nothing of its situation in soft, low, wet ground, or in subterraneous passages, where the work would be subject to constant saturation and hydrostatic pressure—would dry or solidify sufficiently to resist that pressure, or exclude the water from the land for any definite period, if at all.

LIVERPOOL LANDING STAGES.

We regret to have to record the total destruction by fire on July 28th, of the far-famed Landing-Stages at Liverpool, England, a structure generally acknowledged to be "the finest floating platform in the world," and think that a description of the same will not be uninteresting to our readers.

The Docks of Liverpool extend for some six miles in a continuous line on the east side of the river Mersey, and both in their size and construction, being made of solid granite masonry, are unsurpassed by any other similar works. About the centre of their length the landing-stages, recently burnt, were placed, and connected with the shore or pier line by wrought-iron box-girder bridges. The first stage, "St. George's," was built in 1846, and consisted of a large platform 500′ × 80′, supported on wrought-iron pontoons 80′ long × 10′ wide × 6′ deep, placed about 15 ft. apart, and connected together by white pine beams, or girders, placed about 9 ft. apart across the stage.

These pontoons were made of ¼″ plates, lap jointed, with flat top and sides, and rounded bottom; the ends are riveted to the sides, top, and bottom, with 3″ L-irons ½″ thick, and in their length are stiffened by 8 bulkheads of ¼″ plates, riveted to the sides with 3″ L-irons ½″ thick.

The cross girders at the outer edge of the stage consisted of two 12″×12″ beams, and the girders increased in depth towards the centre, the centre girder consisting of three 12″×12″ beams, giving a camber of 12″ to the flooring. The flooring joists laid across these girders were of 9″×9″ timber, and spaced about 3 ft. 9 in. apart. On these was laid the lower layer of flooring of 4″×6″ planks, screwed down to the joists, and on this was spiked the upper layer of 2″×6″ planks; all this wood work was of white pine lumber.

The two box-girder bridges connecting this stage with the pier line of the shore were 150 feet span, 9 ft. 7½ in. deep in the centre, and 5 ft. 10½ in. at the ends, the depth being reduced in the form of a parabolic curve. Each bridge consisted of two of these box-girders, with a road way ten feet broad between them, and two sidewalks each of 6 ft. 6 in. width, supported by 12″×6″ flooring beams spaced 6 ft. apart.

The top flanges of the girders were composed of a wrought iron cell 2′ 6″ long × 1 ft. deep, divided in the centre by a web of 5-16″ plate, running the whole length, and fixed to the top and bottom plates of the cell by angle irons 3″×3″×7-16″. The top and bottom plates of the cells were ⅜″ thick in the centre and 5-16″ at the ends of the girders; their sides were 5-16″ thick, and the whole was riveted together by ¾″ rivets, and 3″ L-irons 7-16″ thick; joints in the plates were covered with strips 4½″× 5-16″. The bottom flange was made of two plates 2′ 6″ wide, each 7-16″ thick in the centre and ⅜″ at the ends, fastened to the webs with 3″ L-irons ¾″ thick, by ¾″ rivets spaced 4″ apart. The double web or sides of the girders were made of plates 2 ft. wide, ¼″ thick in the centre, increasing to ½″ at the ends, and covered at the joints, outside, with strips 4½″ wide, and inside with T-irons 4½″by2½″, and of a thickness equal to that of the plates at the joint.

These bridges were supported at each end on horizontal pivots of hardened steel 8″ diameter, to allow for the rise and fall of the platform due to the tides, and also on turn-tables 10′ diameter, allowing a slight lateral motion to the bridges.

The St. George's Stage was moored to the pier-wall by 6 chains 2⅛" diameter. One single chain at each end ran nearly straight across to the wall, and one double chain ran from each end in a diagonal line to the same mooring posts as the single chain from the opposite end. The stage is also moored to the river bed by two 1¾" chains at each end.

The weights of the George's Stage were as follows:

32 pontoons @ 17½ tons each	560	tons.
Timber beams, joists, and flooring	770	"
Cast-iron cages to mooring posts	11½	"
Spikes, wood screws, and bolts	19	"
Guard chains, railing iron, and iron railing posts	2	"
Iron knees for guard chains, and chains for suspending rubbing beams	6	"
Anchor chains, mooring chains, and fixings	20	"
Turntables of bridges, with end caps of the latter	14½	"
BRIDGES—		
Ironwork in the 2 girders	84	tons.
Timber in flooring and joists	38	"
Spikes, screws, and bolts	1	"
Railing and railing posts	2½	"
Cast-iron curbs	7½	"
	133	tons.
Maximum load on stage, as derived from weight of bridges, occurs at the lowest tide, and from a diagram of forces, amounts to	140	"
Approximate weight of sheds, baggage, and refreshment rooms	60	"
Lamps, lamp posts, landing bridges and sundries	6	"
Total load on the pontoons	1620	tons.

This load immersed the pontoons to a depth of 2′ 11 1-4″, leaving 3′ 0¾″ as depth available for immersion under external loads. The external load necessary to immerse the pontoons entirely, was proved to be 2240 tons, or 125 lbs. per square foot over the whole area of the stage, and one-half the area of the two bridges.

The total cost of this landing stage was £57,000, and it was used entirely for the local traffic of the river ferries.

This first stage was designed and carried out by the late Joseph Cubitt, C. E., and the late Sir William Fairbairn, who also built the Britannia and Conway tubular bridges across the Menai Straits.

In 1857–8, a much larger stage, the Prince's Landing stage, was built to the north of the St. George's Stage, leaving an open space of about 500 feet for entrance to the dock basins. This stage was 1002 ft. 2 in. long by 82 ft. 2 in. broad, and was carried by 63 rectangular flat-bottom pontoons, each 10 feet wide and 5 ft. deep; 49 of these pontoons were 8 feet long; 12, which more immediately carried the four bridges, were 96 feet long, and the two end ones were 12 feet wide.

Their construction was similar to those of the St. George's Stage, but they were connected together by five wrought-iron keelsons, instead of the 9 timber girders used in the St. George's Stage.

These keelsons were 4 ft., 4 ft. 9 in., and 5 ft. deep, giving the deck a camber of 1 ft.; they were constructed of the shape of box girders, top and bottom flanges each made of two ½" plates 3 ft. wide, and two 6 in. L-irons ¾" thick; the sides were made of ¼" plates with 4"×3-16" cover strips, and 4"×3"×⅜" T-iron riveted with ½" rivets. Transverse timber beams 2 ft. deep × 1 ft. wide and 4 ft. apart were laid across these keelsons, and to these was screwed the deck planking, which consisted of a lower layer of plank 6"×4½", and an upper layer of 6"×1½", portions of which were of green-heart timber, but all the remainder of the timber was of white pine.

The bridges connecting this stage to the shore were four in number, each made of two hollow girders, similar to those of the St. George's Stage, but 113 ft. span, 10 ft. deep in the centre, and 5 ft. at the end, with a roadway 14 ft. wide between them, divided by two cast-iron curbs into a 6 ft. cartway, and two 4 ft. footpaths. The general construction of these bridges was similar in all respects to that of the St. George's Bridges, except in some of the details, which were rather simpler. The Prince's Stage was moored to the river wall by 6 chains of 2" diameter iron, and fixed generally like those of the St. George's stage.

The weights of the Prince's Stage were as follows:

49 similar pontoons	883 tons	16 cwt.	
2 pontoons 96 ft. long	259 "	4 "	
2 " 12 ft. wide	40 "	16 "	
			1183.16
Two 4 ft. Keelsons		482. 8	
" 4 ft. 9 in. "		499.10	
One 5 ft. "		253.00	
			1234.18
Timber, beams, flooring, &c.			1670.00
4 boat decks			32. 8
Spikes, bolts, and screws			40. 0
Cast-iron caps to mooring posts			13. 0
Iron straps and knees for guard and mooring posts			15. 0
Mooring chains and fixings			26.00
Guard chains, railings, chains for suspending rubbing beams			4.10
Saddles, axles, and pivots of bridges			28.00
Approximate weight of sheds			70.00
Lamp posts, landing bridges; and sundries			10.00
BRIDGES—			
Ironwork in the two girders		66.00	
333 ft. T-iron for flooring 6"×6"×⅜"		5.00	
One arched stay of the two girders		1.18	
Planking		14.18	
226 ft. cast-iron curb @ 45 lbs		4.11	
Spikes, screws and bolts		1.00	
		93 tons.	
Maximum load on the stage, as derived from the weight of bridges, occurs at the lowest tide, and from a diagram of forces, amounts to			202. 8
Total load on the pontoons			4530. 0

Immersion of the pontoons, due to this load, is about 3 feet, leaving 2 ft. available for immersion under external loads. A load of 82 lbs. per square foot over the whole stage, and one-half the area of the bridges, would suffice to immerse the pontoons entirely.

The total cost of the Prince's Stage was £110,000.

Last year a contract was entered into by the Mersey Docks and Harbor Board, with Messrs. Brassey, the well known contractors of Birkenhead, to build a stage joining the St. George's and Prince's Landing Stages, making a grand platform of some 2010 in length. In this new portion was also to be built two semi-circular embayments to receive two circular shaped ferry-boats, to be built according to the designs of the talented Engineer to the Board, Mr. Geo. F. Lyster. These circular ferry-boats were to be built to carry carriages, carts, wagons, &c., across the river, as the accommodation in the existing ferry boats is very defective in this respect; in fact, but few ferry-boats in England are built for any but passenger traffic.

The flooring of this new portion was of green-heart timber, the joists and carrying beams of red pine, all carefully soaked in creosote for some weeks, and the general construction was similar to that of the other two stages.

In fixing the gas pipes *underneath* the flooring, an end was left open, through which the gas escaped, and becoming alight, speedily communicated to the *underside* of the flooring, and though the fire engines were speedily on the spot, nothing could be done to prevent the total destruction of the stages. The new portion burnt more readily than the old, but eventually the whole was destroyed, involving an estimated foss of £250,000 of which some £80,000 will fall upon the contractors, who had just completed the new portion of the stages, but not formally turned it over to the Mersey Dock Board.

It should be mentioned that the Prince's stage was used by the various coasting steamers, and the tenders to the great ocean steamships, conveying emigrants and other passengers and their baggage thereto.

The ton referred to in this article is the *long* ton of 2240 lbs., which is universally used in England.

SINCE the article on the Hyde Park and Lake Water Works was written we have learned that a more thorough experimental investigation will be made this week; it will also be fully reported in our next issue.

LAW AND LEGISLATION.

An abstract of decisions of the Supreme Court of the United States and of the courts of the various States in the Union upon questions relating to boundaries, surveys, etc.

105. A survey adopted by the land office, though not made by the regular officer, may be read in evidence. Harris v. Monks, 2 S. & R. (Pa.), 557.

106. Every presumption is to be made in favor of the regularity of a survey made by a sworn officer, returned into the land office and accepted, until contrary is proved by the party who impeaches it, and such survey vests a legal title. Griffith v. Tunckhouser, Pet. C. C., 418.

107. A survey fairly made without application of the owner is binding on him. Hunter v. Meason, 4 Yeates, 107.

108. The acts of a deputy surveyor in the course of his official duty, are admissible in evidence to show for whom the survey was made. Vincent v. Huff, 4 S. & R. (Pa.), 298.

109. The owner of land is not prejudiced by a fraudulent survey or return of the deputy surveyor. Bayles v. Kelly, 10 S. & R. (Pa.), 214.

110. After a survey is once made and returned, the deputy surveyor cannot alter the lines on the ground of mistake; and evidence of such resurvey is inadmissible. Healy v. Moul. 5, S. & R. (Pa.), 181,

111. A survey made by the surveyor of a county, unless the land warrant be previously deposited with him, is only a private survey. Jones v. Tayler, (Ky.), Dec. 82.

112. If the order for a survey of land do not certainly determine the form in which it should be made, the survey ought to be in a square. Kennedy v. Payne, Hardin 10.

113. A location without due diligence to obtain a survey, gives no right of pre-emption to land. Peaceable v. Nicholls, 1 Yeates, 293.

114. Definite boundaries given in a deed will limit the generality of a term previously used, which, if unexplained, would have included a greater quantity of land. Allen v. Allen. 2 Shep. (Maine), 387.

115. In locating lands, the following rules are resorted to, and generally in the order stated: 1st, natural boundaries; 2nd, artificial marks; 3rd, adjacent boundaries; 4th, course and distance. Neither rule, however, occupies an inflexible position; for, when it is plain that there is a mistake, an inferior means of location may control a higher. Fulwood v. Graham, 1 Richardson (S. C.), 491.

116. The admission of a party of a mistaken boundary line, for a true one, has no effect upon his title. Crowell v. Bebee, 10 Verm., 33.

117. A mistaken location of the line between the owners of contiguous lots is not conclusive between the immediate parties to such location, but as between them, it may be corrected. Colby v. Norton, 1 App. (Maine), 412.

118. If one of such parties sees a third person take a conveyance for a valuable consideration, according to the monuments by him located, he will be concluded thereby. (*Ibid.*)

119. In questions of boundary, long and notorious possession authorizes the reference of any fact which can rationally be inferred to make such possession consistent with the right. Norcom v. Leary, 3 Iredell (N. C.) 49.

120. Where two persons own equal parts of a lot of land in severalty, but not divided by any visible monuments, if both are in possession of their respective parts for fifteen years, acquiescing in an imaginary line of division during that time, that line is thereby established as a divisional line. Beecher v. Parmele, 9 Verm., 352.

121. The owners of adjoining lots of land may enter into agreement by parol to establish the boundaries of their lots, and such agreement, when executed, will be conclusive against them, and all persons claiming under them, as to the line of said lots. Gray v. Berry, 9 Hamp., 473.

122. A division line which has been agreed upon for thirty years, cannot be altered. Chew v. Morton, 10 Watts, (Pa.), 321.

123. Possession of part of a tract of land, under a lease defined by prescribed boundaries, is not a possession of the whole tract; it is only commensurate with the boundaries. Ross v. Cobb, 9 Yerg. (Tenn.) 463.

124. If the summit of a mountain be, by law, made the division line between counties, and the mountain be not continuous, but breaks off and the lands pass each other, forming an intervening valley between them, upon the one side of which the mountain is gradually sinking and terminating, and on the other side is commencing and rising, a line from one to the other, at or about the place where the mountains acquire an equal height, is the legal dividing line; and no common usage or assent of the authorities of the counties would alter this so as to affect the title to land elder than the usage. Beale v. Patterson, 3 Watts & Serg. (Pa.) 379.

125. Every call in the description of the premises in a deed must be answered, if it can be done, and the intention of the parties is to be sought by looking at the whole and none is to be respected if all the parts can stand consistently together. Herrick v. Hopkins, 10 Shep. (Maine), 217.

126. Where a deed describes land by its admeasurements, and, at the same time, by known and visible monuments, these latter shall govern. Mayhew v. Norton, 17 Peck (Mass.), 357. Massengille v. Boyles, 4, Humph. (Tenn.), 205. Woods v. Kennedy, 5 Monr. (Ky.), 174. Nelson v. Hall, 1 McLean (U. S.), 518. Campbell v. Clark, 8 Mis., 553. Newman v. Foster, 3 Hon. (Miss.), 383.

127. Where a deed calls for natural objects and an older survey line under the mistaken supposition that they correspond, if it turn out that they do not correspond, and the elder line can only be found by compass and chain, while the natural objects are clearly defined, the latter must govern. Hare v. Harris, 14 Ohio, 529.

128. Where the length of a line is written across a plat which accompanies a grant of land, it will not control the boundaries which are expressly declared in the grant. Hallett v. Doe, 7 (Ala.), 882.

129. Each section or subdivision of a section is independent of any other section in the township, and must be governed by its marked and established boundaries. And should they be obliterated, a last recourse must be had to the best evidence that can be obtained, showing their former situation and place. Leven v. Smith, 7 Port. (Ala.), 428.

130. It is a well settled rule that where an actual survey is made and monuments marked or erected, and a plan afterwards made, intended to delineate such survey, and there is a variance between the plans and survey the survey must govern. Thomas v. Patten, 1 Shep. [Maine], 329.

131. But no such rule has obtained where the survey is subsequent to to the plan. *Ibid.*

132. A survey, though ancient, made by the direction of the owner of the land for his own convenience, is not admissible evidence for him, or those claiming under him. Jones v. Huggins, 1 Dev. [N. Y.], 223.

133. A conveyance of land purporting to be bounded on other lands, cannot be so construed as to include the lands on which it is bounded. Nash v. Atherton, 10 [Ohio], 163.

134. Proceedings under the act of 1806 must be strictly construed, and where a processional survey is sought to be set up in bar of the rights of a party, it must appear that it was made in conformity with the requirements of the statute, either by proof of their performance, or by presumption arising from long acquiescence in the survey. Where a processionnal survey is attempted to be sustained by adoption, such adoption must be positive, mutual, and made with the knowledge of the party sought to be charged that he was surrendering his rights. Chouning v. Simmons, 5 Humph. [Tenn.], 299.

135. If granted line, not originally marked by the surveyor, be afterwards marked by the owner, of the whole or part, in good faith, and in reasonable comformity with the calls of the patent, such private marking operates as an *estoppel* on all parties. Riggs v. Parke, 1 Meigs [Tenn.], 43.

136. What marking is bona fide, and in reasonable comformity with the calls of the patent, is a question of fact depending on the circumstances of each case. *Ibid.*

137. A grant called for a certain number of poles "to a stake, crossing "the river." Held that the line must cross the river, though the distance terminated before entering it. Whiteside v. Singleton, 1 Meigs [Tenn.], 207.

ENGINEER, ARCHITECT AND SURVEYOR.

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CHICAGO, ILL., AUG: 15, 1874.

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OUR ILLUSTRATIONS.

CHICAGO PORT AND HARBOR.

In connection with our illustrated supplement it is thought that a few statistics will be of interest to our readers, regarding the trade which renders Chicago such an important port, and necessitated the recent improvements in harbor accomodations which are illustrated in this number.

These statistics are compiled from the 16th Annual Report of the secretary to the Board of Trade of this city, kindly furnished us by Chas. Randolph, Esq., Secretary, and from the 15th Annual Report of the Chicago Board of Public Works.

As a sample of the grain producing country lying behind this City, the acres under cultivation in the State of Illinois for the year 1859 were, Wheat, 2,259,648; Corn, 4,020,399 other field products, 1,084,579; and for the year 1872: Wheat, 2,166,407; Corn, 7,304,540; other products, 2,781,320; shewing in this period of 14 years, a decided increase in corn and general products, and a slight decrease in wheat.

The total exports to foreign countries of the articles named, as reported officially at Washington, for three years, ending June 30, 1873, were as follows:

	1873	1872	1871
Flour, barrels,	2,262,086	2,514,535	3,653,841
Wheat, bushels,	39,204,285	26,428,080	34,304,906
Corn, do	38,541,930	34,491,650	9,826,306
Rye, do	562,051	794,967	49,674

Of these four articles, there were received in this City during the year 1873,

	FLOUR. Barrels.	WHEAT. Bushels.	CORN. Bushels.	RYE. Bushels.
By Lake,	47,875	39,490	.....	.....
" Railroad,	2,439,501	26,227,072	38,157,232	1,189,464
	2,487,376	26,466,562	38,157,232	1,189,464

the receipts by Lake being into small proportion of those by rail.

The shipments during the same time were:

	FLOUR. Barrels.	WHEAT. Bushels.	CORN. Bushels.	RYE. Bushels.
By Lake,	428,321	15,528,984	34,487,205	690,604
" Rail,	1,875,169	8,926,673	2,267,738	270,604
	2,303,490	24,455,657	36,754,943	960,613

the shipments by Lake being in the case of flour, about ¼th, in wheat, 1¾ths, in corn 16¼ times, and in rye, 2½ times the amount of those by rail.

Of other articles, lumber and shingles form the principal proportion and for the year 1873 were as follows:

	Lumber (feet)	Shingles (NO.)
Receipts by Lake,	1,020,638,000	294,548,000
" " Rail,	102,730,671	223,375,000
	1,123,368,671	517,923,000

the receipts by Lake being in the case of lumber, 10 times, and in that of shingles 1⅓ times those by rail.

	Lumber (feet)	Shingles(NO.)
Shipments by Lake,.....	1,506,700	900,000
" " Rail,.....	560,037,679	406,605,650
	561,544,379	407,505,650

the shipments by rail here showing a very large excess of those by the Lake, as was to be expected from the nature of the articles.

The tonnage dues and total dues of all kinds collected on vessels for the years 1872 and 1873, were:

	1873	1872
Tonnage Dues,.....	$10,220.37	$10,280.25
Total Dues,.....	39,882.17	37,255.17

showing an excess in total collections of 1873 over 1872 of $2,627.01.

The total direct exports from this port to Europe, of the three articles named, were as follows:

	FLOUR. Barrels.	WHEAT. Bushels.	CORN. Bushels.
By Lake,.....	65,185	371,171	8,600
" Rail,.....	66,232	1,058,777	....
Total,.....	131,417	1,429,948	8,600
Similar Shipments in 1872...	16,293	268,617	388,970

these shewing in the first case in 1873, almost equal shipments of flour by lake and rail, of wheat shipments by lake but little over ⅓rd of these by rail, and of corn, all shipments by lake; and secondly, that the general totals (except in the case of corn,) of the shipments were a very largely decided increase in 1873 over 1872.

The increase in the arrivals at and clearances from this port during a period of 14 years, commencing with 1859, was found to be as follows,

	ARRIVALS.		CLEARANCES.	
	Vessels.	Tonnage	Vessels.	Tonnage
1859.....	7,417	1,931,692	7,270	1,915,554
1873.....	11,858	3,225,911	11,876	3,338,803
Increase,.....	4,441	1,294,219	4,606	1,423,249

For the Storage of grain in the City, there are 14 large Elevators of a total capacity of 12,600,000 bushels, in separate quantities as follows; one elevator of 1,500,000 capacity, two of 1,250,000, four of 1,000,000, one of 850,000, three of 750,000, one of 700,000, one of 600,000, and one of 200,000.

The length and area of the Chicago river, canals, basins, and total dock frontage are shown by the following table:

	Length in Feet.	Average width in Feet.	Area in square feet.
Main River,.....	7,000	300	2,100,000
North Branch,.....	24,000	175	4,200,000
South "	21,500	175	3,762,000
West Branch of South Branch,..	17,100	75	1,282,500
South Branch of South Branch,.	9,300	75	697,500
Slips, Canals and Basins,.....	37,150	100	3,715,000
	116,050 2		15,757,000 or 361.7 acres
Total Dock Frontage,.....	232,100 or 43 miles 5060 feet.		

All the above figures clearly show the importance of Chicago as a port.

Constant complaints have been and are being made of the over crowding of the river by the lumber vessels, and this will continue until the new harbor is completed, forming ample and well protected anchorage ground for vessels not in immediate want of wharf accommodation.

For several years the Board of Trade had petitioned the General Government to provide greater and better harbor accomodations for the port and this call was responded to by instructions sent to the U. S. Engineer in charge of this District to examine and report upon the best means of constructing the required harbor. Col. Wheeler who was then the engineer-in-charge, made the necessary soundings and plans, and submitted the general plan shown on our supplement.

This plan was to continue the extension of the south pier as then existing, until it was equal in length to the north pier, then build the eastern breakwater at right angles extending southward for 4000 feet, and join the extremity of this breakwater to the shore by a pier. An opening of 300 feet was to be left in the pier forming the north side of the basin, to admit vessels from the Harbor entrance. This Basin would contain 275 acres, one-third having a depth of 12 feet of water, and the remainder a depth of over 7 feet, which could be easily deepened to 12 feet.

The estimated cost of the eastern breakwater to be made of 80 cribs, each 50′×50′×30′ was $602,252.00.

The outer half of the southern breakwater, 1700′ in length, was to be made of 34 cribs, each 50′×25′×24′ and to cost $167,418.38; the inner half, 1760′ in length was to made of 55 cribs, each 32′×20′×17′ and to cost $97,425.35; adding $30,000 for dredging, the total estimated cost amounted to about $900,000.

This was submitted and approved in the year ending June 30th, 1870, and during that time the south pier was extended 1,224 feet as proposed up to the water surface and super structure 3′ high finished over 614′ of the same.

An appropriation of $100,000 was then made by Congress for prosecution of the work, and the contract let to Fox & Howard of this city. Work was commenced at the north end of the breakwater and up to October 20th, 1870, 29 cribs each 50′×30′ were sunk, making 1450 ft. of breakwater; 300′ of this was a return of the north end of the breakwater running west. The superstructure 6′ high also was completed over 1000′ of the work done on the extension of the south pier during the previous fall. On March 3rd, 1871, Congress appropriated an additional $100,000, and a contract was let to the Illinois Central R. R. Co. on May 30th, '71, to continue the work.

The first crib was placed in 24′ water; no cribs were placed in less than 18′ water, and where necessary to obtain that depth, dredging was resorted to. The cribs stood the storms very well though much exposed.

There were constructed up to June 30th, 1872, 2,250′ of breakwater, including superstructure, very nearly finished at a cost of $200,000, or $88.88 per running foot, this sum

including the protection of the north end of the work by clumps of piles. In that year (1872), Col. Houston advised his Department against the construction of the south pier proposed in the original plan, on the ground that it would interfere with the navigation of the Lake front, and further advised that the next appropriation should be applied to the extension southward of the eastern breakwater then being erected, as it would afford all the protection necessary for the Harbor.

The work done during the year ending June 30th, 2873, consisted in further extension of the breakwater southward for 860′, making total length of breakwater at that date, 3050′, and completing the superstructure, excepting the west half of the decking, up to the beginning of the aforesaid extension. This was done by the Illinois Central R. R. Co., under contract dated August 7th, 1872.

On May 27th, 1873, Messrs. Fitzsimmons and Connell contracted to build 1,100 feet of breakwater up to the water their contract terminating and that work being concluded on the 1st ult., leaving 150 feet of breakwater, and 2050 feet of superstructure to complete the original plan for the eastern breakwater, for which Col. Houston asked an appropriation of $75,000, granted by Congress last June.

His account of the expenditure already made and that necessary to complete the work in 1873, was as follows:

Amount available July 1st, 1872,.....	$ 98,161.11
" appropriated by act of March 3rd, 1873,.....	90,000.00
Amount expended during the year ending June 30th, 1873, including $6,866.32 retained from contractors,.....	188,161.11 84,603.97
Amount available July 1st, 1873, ...	103,557.15
" required for year ending June 30th 1875,.....	150,000.00
	$253,557.15

It is suggested that the north pier at the entrance to the river, be extended to afford greater protection to the said entrance, and the reasons given for the extension advised are as follows:

The works on both sides the entrance to the river are out an equal distance into the lake, and during north, northeasterly, and northwesterly blows, a heavy sea rolls in along the return and into the entrance to the harbor-basin, making it difficult and at such times dangerous to take out stone and other materials to the works. At such times too the sea strikes the return, and is deflected across and into the slip at the north pier, making difficult navigation from east of the lighthouses, especially where the water is 14 ft. deep and less, as loaded vessels are likely to strike. The shallowing of the river is formed by deposit during gales. Adding to the return would not prevent the rough sea between the north pier and it, and only partially give protection to the entrance into the basin or harbor, while it would injure materially, by narrowing the entrance. Lengthening the north pier 400′ or 500′ (as shown by the dotted lines on the general plan in the supplement), would afford all the safety needed to docks inside the basin, and would save the present width between the return and end of south pier, and make it comparatively easy for vessels from outside to sail into the outer harbor.

The following method of building foundations for a crib was adopted, and answered admirably:

As soon as the crib is in position, it is loaded with stone, until it settles to within about 4 ft. of the bottom of the lake. Fine rock is then thrown in, which passing through the grillage bottom, settles evenly under and around the sides and ends of the crib; the latter is then filled up with coarse stone, and rip-rapped with about 10 cords of heavy rock. To hasten building of the foundation, it is suggested that a portion of fine rock be put in through a dump scow just before the crib is brought up; in this case coarse rock would be used.

The breakwater is composed entirely of cribs, each 50′×30′×26½′, devised and adopted by Major D. C. Houston, U. S. corps of Engineers, and fully illustrated in our supplement.

The following table is a summary of the bill of materials for one crib:

No. of courses from the bottom.	TIMBER. LENGTHS IN FEET. 12″×18″ 30′	12″×18″ 20′	12″ × 12″ 46′	12″ × 12″ 30′	12″ × 12″ 28′	12″ × 12″ 22′	12″ × 12″ 21½′	12″ × 12″ 20′	12″ × 12″ 14′	12″ × 12″ 6½′	12″ × 12″ 2′	Am't in lineal feet.	1⅛ inch square bolts. Lengths. 32′	24′	20′	Weights in Pounds.	Stone. Cords.
bottom.	2	2	20	117	59	30	2	20	20	60	72	8099	900	28	219	12061.14	216.303

All the timbers are 12 inches square, except the side timbers of the first course, which are 12 by 13 inches.
16 cords of brush to be placed in intervals between cribs.
7 " stone " " over the brush.
450 feet [B. M.] of 3 inch plank for foot walk. 9 pounds of 6 inch spikes.

The 21½ ft. timbers, which constitute the base of the centre wall, are bolted to 4 of the transverse grillage timbers; at the intersections of the remaining 6 grillage timbers, crossing the centre wall, 20 inch bolts are driven through the longitudinal grillage timbers. As the blocks of the solid cross-walls are required to be bolted in their proper places before gains are cut, they are counted as being each 28 ft. long, which is the full inside width of the crib. The horizontal planes of the side timbers are taken in estimating the quantity of stone contained in each course; the first being 18 inches in height; the space occupied by the lower halves of the cross-timbers, and the central longitudinal timber being deducted from the gross quantity contained in the parallelopipedon. Beginning with the 4th course, blocks each 2 ft. in length (12″ by 12″) will be placed between ties at equal distances from the sides and centre longitudinal wall of the crib, making solid supports to the water surface. Such blocks will be fitted tightly, and secured by a 20 inch bolt, driven from the upper tie into the block.

In conclusion, our sincere thanks are due to Col. Houston, who placed all necessary plans and reports at our disposal, and to Chas. Randolph, Esq., Secretary of the Board of Trade, who furnished us with his Report, and other information of service to us.

ANSWERS TO CORRESPONDENTS.

ATLANTA, GA., Aug. 28, 1874.

MR. EDITOR:—When measuring a race-track, to ascertain its exact length, do you take it at three feet from the inside line, or at three feet from the centre line, towards the outside? M. C., City Engineer.

In measuring a race-course, as in all curved roads, the length measured along the centre line is taken as the "length of the course." We presume the three feet width you mention as measured or spaced off from the *inside* line of the course, is a local custom in your race-course, laid down or marked by posts, to prevent the horses from colliding with the inside line of the course. If this view is correct, the width of the course is virtually reduced by 3 feet, and the length to be measured will be along the centre line between the boundaries of this reduced width. EDITOR.

MORENCI, MICH., Aug. 31, 1874.

MR. EDITOR:—Surveyors are generally aware that an east and west line cannot be back-sighted, because parallels of latitude are curves. In order to do away with this difficulty I have calculated the following tables. The calculations are made for the 42nd parallel of latitude, (assuming the mean radius of the earth to be 3,956 miles) and can be used for short distances, north or south of said parallel. Yours respectfully,

JAS. BLAIR.

A Table of Ordinates to be used in restoring lost corners on the 42nd parallel of latitude, for distances from ½ to 5½ miles in fractional parts of a chain.

Distance in miles meas'ing East or West.	ORDINATES AT EVERY HALF-MILE.										
	½	1	1½	2	2½	3	3½	4	4½	5	5½
1	.003	....	....	....	....	....	....	....	....	....	....
1½	.009	.009	....	....	....	....	....	....	....	....	....
2	.009	.013	.009	....	....	....	....	....	....	....	....
2½	.012	.019	.019	.012	....	....	....	....	....	....	....
3	.015	.025	.028	.025	.015	....	....	....	....	....	....
3½	.019	.031	.037	.037	.031	.019	....	....	....	....	....
4	.022	.037	.047	.049	.047	.037	.022	....	....	....	....
4½	.025	.043	.056	.062	.062	.056	.043	.025	....	....	....
5	.028	.049	.065	.075	.078	.075	.065	.049	.028	....	....
5½	.032	.057	.076	.088	.095	.095	.088	.076	.057	.032	....
6	.037	.062	.084	.099	.108	.112	.108	.099	.084	.062	.037

A Table of perpendiculars to be used in projecting the 42nd parallel of latitude from any point in the same.

Miles E. or W.		Miles E. or W.	
½	.003 ch.	3½	.152 ch.
1	.011 "	4	.199 "
1½	.028 "	4½	.252 "
2	.049 "	5	.311 "
2½	.078 "	5½	.376 "
3	.112 "	6	.447 "

MESSRS. EDITORS:

With much pleasure I hailed the advent of the E. A. & S., as a medium through which we Surveyors, Engineers, and Architects can exchange thought upon the theories and practice of our profession. Last April I asked you the simple question of how to divide a ¼ section of land (an even ¼). Your answer was agreeable to my practice. (See May No, page 24). I have waited to hear discussion upon this subject. "B. K." has advanced a contrary opinion, or rather laid down an opposite practice, on page 63; "T. H." on page 79, affirms your practice. I hope this subject may be kept upon the "trestle" board for awhile, for upon this question hangs a vast interest in the North-west. When Surveyors-General and Land Commissioners disagree who shall decide? Shall we practitioners "hang our harps upon the willow?" Shall we tell our constituents that this class of alignment cannot be effectually settled by possession and limitation? For 30 years I have had much correspondence with the Land Department upon these minor subdivisions, and not until I saw Hawes' Manual of the U. S. Land System, did I learn of such a theory as "B. K." lays down. The U. S. law for dividing a section into ¼ths, is not, nor can' be misconstrued. We all agree in this point. First, the Township, then the Sections, then the ¼ Sections, each laid off as independencies, with monuments placed at the corners of the several tracts except the centre of a section, for the establishment of which Congress has given a plain and simple rule, in the Act of Feb'y 11, 1805, which reads, "And the boundary lines which shall not have been actually run and marked, shall be ascertained by running straight lines from the *established* corners to the opposite corresponding ones." Hence we have undisputed law for dividing the public domain into divisions, the smallest of which is a ¼ section. To divide this smallest division, viz, a ¼ section into quarters, the spirit of the law cannot contemplate the running of a line across another independent quarter, for the purpose of establishing a quarter quarter line across a quarter section. That would be complex, and at variance with the geodetic system of U. S. surveys. It would be making points not equi-distant upon the bounds of the tract, to be divided, viz: on the ¼ section lines which were pre-established according to law. I have written to the Land Office Department, I think, six times upon this point; four times, for the purpose of obtaining facts to induce our Legislature (Wisconsin) to alter her laws relative to surveying, about 1851, 2, 3, & 4. The answers I received, as well as the two I have in hand of a more recent date, do not sustain Mr. Hawes' or "B. K.'s" theory. The first four I have not now in my possession. The two last read as follows: Commissioner Willis Drummond writes under date of Aug. 22, 1872, "the lines subdividing a ¼ section should be run from the quarter quarter corners to the opposite corresponding corners and the common centre established at the intersection of these lines, each quarter section to be subdivided independently."

W. W. Curtis, acting commissioner, writes under date of Nov. 18th, 1872, "To divide the quarter sections, quarter quarter corners should be placed at points *equidistant* on straight lines between the corners already established, (He had in a preceeding paragraph described the method of of dividing a section into quarters,) and *each quarter* subdivided by running straight lines from these quarter quarter corners to the opposite corresponding corners, establishing the common centre at the intersection of the lines so run." W. H. C.

P. S.—I regard this matter of difference in the theory of subdividing a ¼ section as unfortunate to the country, and a blot upon the geodetic system. I hope the matter will be discussed.

WAUKEGAN, Aug. 28th, 1874.

MESSRS. EDITORS;

I am not only pleased, but very much instructed by your paper, and have a particular interest in the information contained in the column of "Answers to Correspondents," In further reply to your answer to question No. 2, of J. M., of Shawano, Wis., I will suggest the propriety of testing the corner, by digging, to find the old post hole. By carefully removing the surface soil with a *sharp* instrument, so as to leave a smooth surface, the old hole can be seen and distinguished by the different color of the soil in the hole; if the sun shines on the spot so much the better.

In reply to B. F. D., Waupaca, Wis., I will make a few suggestions. By Congressional Act of Feb. 11, 1805, the boundary lines actually run, and the corners actually established by the Government Surveyors, are held to be the *true* boundaries and corners. Here we have a base, a ground work from which to make deductions. The usual course has been to run the section lines *from* south *to* north, and *from* west *to* east, connecting the east and west line to make it close on the section corners. Now, in fractional sections on Lake Michigan, there can be no corners upon which to close, consequently it is to be supposed the meander corner was placed at the end of the random line. If the fractional section does not run to a point at the other end, or, in other words, if there should be a *north line* to the same section, it would be run in the same manner, consequently the ¼ line should be run on an intermediate course. If the lines are short, and the courses very nearly parallel, running the ¼ line parallel with either, will, perhaps, be near enough for practical purposes; but even then I would prefer to base it on the south line. Cases sometimes occur where the meander corner cannot be found, having been washed away. Now the question is more difficult. It is known that the Government lines rarely run parallel, and as rarely due east and west. It is quite certain that the line should be re-run with the same variation used by the Government surveyors, because the computations are made on that basis. In such cases my theory is this: if there is more than one line tree between the section corner and the lake, continue the line on the course between the last two trees; if there is only one, continue it on the course between the section corner and line tree. If there is no line tree there, then run the line on the course of the section line immediately west of it; I may be wrong but I think it comes as near following the direction in the law as any other plan.

I think the same principles apply in all cases, that is, the hypothesis to be based upon the *manner* in which the survey was first made. This makes the possession of the Government "running" notes almost an absolute necessity. In our county there is one section cornering on Lake Michigan, which cannot be divided according to general rules, because it was not surveyed according to the general rules. This communication is already much too long, so I close. H. W.

KNOXVILLE, IOWA, Aug. 28, 1874.

MR. EDITOR:

Please give the right method of finding a lost township corner, and oblige, M. F. M.

ANS. Identify if possible by the *running* notes, the original location of the missing corner. These failing, trace out the township lines to the north and south of the lost corner until well authenticated monuments are obtained; run from these, true meridian lines, and divide the intermediate distance *pro rata* according to the Government notes. If the notes show no jog at the corner, run a straight line between the points found, and divide *pro rata*. If the townships adjoining have been surveyed in different years, or by different surveyors, then the present chaining must be compared with the chaining of each before dividing the intermediate distance for the lost corner. EDITOR.

Silver wire has been run through plates of rubies to the length of 170 miles, in which the most delicate test could detect no difference in diameter in any part. Gold and platinum have been drawn to a spider line for the diaphram of a telescope, by coating the metal with silver, drawing it down to the finest number, and then removing the coating by acid, leaving the almost imperceptible interior wire, which, in an experiment made in London, was so attenuated that a mile's length weighed only one grain; or one lb., Troy weight, would extend almost from Liverpool, Eng., to San Francisco, California.

HYDE PARK AND LAKE WATER WOKKS.

COOK COUNTY, ILLS.

In view of the recent trial of these works, we think a short description of the works, and their trial as set forth in the Report of the Superintendent, subjoined, will be of interest to our readers, especially as they are constructed upon the Holly system, which is at present attracting so much attention throughout the country.

Out of 68 towns and cities, with systems of water supply, in ten different States, 39 are using the Holly system; the system is in operation in 58 different cities, and works are in process of completion for Flushing, N. Y., Atlanta, Ga., Middletown, O., Kansas City, Mo., and Pueblo, Col.

The works in Hyde Park are situated 4⅝ miles from the corner of Cottage Grove Ave. and 39th Street, and about three miles from the corner of Hyde Park Ave. and 53d Street, at which two points the recent trials were made.

The recommendation made in the Superintendent's Report, concerning a thorough and scientific experimental examination of the works, is one which we cordially endorse, and strongly urge upon the Board of Trustees the necessity of knowing not only the capacity of the pumps, but also the efficiency of the engine and boilers, which can only be ascertained by careful experiments on the amount of water evaporated, of coal used, temperature of feed water supplied to the boiler, indicator diagrams off the engines and pumps, &c., &c. From the knowledge gained by these exper iments, the superintendent can economize in the fuel used, and make the corrections that may be found necessary in the valve motions of his engines.

The following is a description of the machinery in the pumping house: two pairs of double cylinders, quarter crank, condensing piston steam engines, mounted upon a heavy iron arched frame, the four cylinders for these engines are each 14 inches in diameter and 24 inches stroke, and so connected at the crank shaft as to take steam from eight different points in each revolution. There is attached to the above named frame four double-acting pumping engines, each driven directly by one of the above-named steam cylinders, said pumping engines each nine inches in diameter and 22 inches stroke, and taking suction at 8 different points in each revolution for the purpose of imparting as nearly as practicable a uniform flow and steady pressure of water in the pipes and mains of the city, and so connected that either or any of the cylinders may be run separately or together. The necessary steam boilers, two in number, of sufficient size and capacity to generate steam and supply the steam engines, to enable them to perform the duty specified. Holly's patent variable steam cut-off, so arranged as to be operated upon by the pressure of water in the mains for the purpose of regulating the supply of steam for the engines in the proportion due to the constantly varying demands for water by consumers. Holly's patent hydrostatic pressure gauge to regulate the speed of the engines, by the pressure of the water in the mains and pipes, and to enable the operator to change the same at pleasure, for manufacturing and other general uses, and for fire protection, and to maintain, as nearly as may be necessary for practical purposes, the degree of pressure at which it may be set. There is also one of Holly's patent rotary steam engines of 150 horse power, and two Holly's patent rotary pumps for the purpose of throwing six streams. The necessary gearing, shafting, couplings, connections, steam-pipes and fittings, steam valves, water valves, vacuum and pressure-gauges, blow-off cocks, try-cocks, fire-fronts, breeching and grates, etc., are also supplied, so that the entire arrangements are most complete.

The water used is supplied from a 16-inch iron pipe which runs out into Lake Michigan to the filtering crib, a distance of 1,000 ft., between two rows of piling.

The maximum capacity of the works is estimated at 3,000,000 gallons in 24 hours. The cost of the machinery was $36,000, and the buildings and crib will bring the entire cost of the works to about $80,000. There is already laid in the village of Hyde Park 13½ miles of pipe, and the village has advertised for an additional 25 miles, to be laid this year. The works will also supply the town of Lake, and 30 miles of service pipe have already been laid in that town. This will make nearly 70 miles of service pipe. A public trial will soon be made in the town of Lake, and the ability of the engines to throw a stream which will be available for fire purposes, at a distance of eight miles from the water works, will be practically tested.

REPORT OF SUPERINTENDENT OF WATER WORKS.

HYDE PARK, Sept. 7, 1874.

TO THE PRES'T AND BOARD OF TRUSTEES, VILLAGE OF HYDE PARK:

Gentlemen:—Below please find record of observations, taken during the contract test of your Water Works, on the afternoon of the 2d inst. The observation of steam and water pressures, &c., at the pumping works were taken by D. C. Cregier, Chief Engineer of the Chicago Water Works. and Mr. John F. Barney, Mechanical Superintendent of the American Bridge Co.'s Works, and the observations of hydrant pressures, elevation of streams, &c., were taken at the city limits, near Cottage Grove Avenue, by Col. J. T. Foster, Engineer of the Town of Lake, and S. G. Rhoades, Engineer of Village of Hyde Park, and on Hyde Park Ave., near the village hall, by J. H. Sams and R. W. Dobson, Civil engineers.

The 1¼ in. stream was thrown through 250 ft. of hose attached to two hydrants, 150 ft. being attached to one nozzle of one hydrant, and two lengths of 50 ft. each being attached to the nozzle of the other hydrant.

During the time the seven streams were playing, the steam pressure at the pumping works was 75 lbs., and the water pressure varied from 155 to 160 lbs., the work being performed by the two rotary pumps, driven by the four piston engines, running at the rate of 62 revolutions per minute. During the time the 1¼ stream was being thrown, the steam pressure was from 65 to 67 lbs., the water pressure at the pumping works varied from

120 to 169 lbs., and the water pressure on the hydrants, near the city limits, varied from 115 to 140 lbs., the work being performed by one rotary pump, driven by four piston engines, the revolutions of the pumps and engines being coincident, and varying from 82 to 86 revolutions per minute, the engine cutting off at ¼th the stroke, or 6 ins.

Time.	Pressure on Steam Gauge at Water Works	Pressure on Water Gauge at Water Works	Pressure on Water Gauge at cor of Cottage Grove ave. and 39th st.	Length of Hose.	Diameter of Nozzle.	No. of Streams.	Angle of Elevation.	Length of Base.	Elevation of solid col'n	Elevation of jets.	By whom Measured.
P. M.	lbs.	lbs.	lbs.	ft.	in.		24° 45′	ft.	ft.	ft.	
2.5			138	50	1	6		205	99	128.5	J. T. Foster.
2.7½			135	50	1	6	32 15	195			S. G. Rhoades.
2.10			135	50	1	6	17 48	205	70.3		J. T. Foster.
2.11			130	50	1	6	34 00	195		137	S. G. Rhoades.
2.15			140	50	1	6	24 45	205	99		J. T. Foster.
2.20			140	50	1	6	39 11	195		164.4	S. G. Rhoades.
2.22			140	50	1	8	30 25	205	124.8		J. T. Foster.
2.27 A	75	155 to 160	145	50	1	7	37 57	195		157.5	S. G. Rhoades,
2.29½	75		128	50	1	7	20 00	205	79.1		J. T. Foster.
3.18	65	120 to 140	115	2 of 50 1 of 150 =250	1¼	1	32 00	195	127.3		S. G. Rhoades.
3.25	67	169	145	250	1¼	6	36 00	205	153.4		J. T. Foster.
2.00*				50	1	1				145	J. H. Sams.
5.00*	75	150 to 155	160	50	1	4				193	and
5.45*				250	1¼	1				172	R. W. Dobs'n

A One length of hose was torn from the coupling.—*These tests were made, and pressure on the water gauge (160 lbs.,) measured at the corner of Hyde Park Ave. and 53d Street.

NOTE—Col. Foster's Theodolite stood 4½ ft. above the ground.
Mr. Rhoades' Transit " 5½ ft. " "

While the four 1" streams were playing on Hyde Park Ave., near the Village Hall, the steam pressure at the pumping works was 75 lbs., and the water pressure varied from 150 to 155 lbs. per square inch, the work being performed by two rotary pumps driven by four piston engines, cutting off at 8-11ths of the stroke, or 17½ ins., and making 26 revolutions per minute.

I would respectfully call your attention to the fact that during the above test, the direct acting pump, the rotary engine, the condenser, and the automatic fire alarm, were not brought into service. Messrs. Cregier and Barney speak very favorably of the workmanship of the machinery, and of its operation so far as they were able to observe it, but a large portion of the machinery was not in use, and they are unable to make a complete report. I would very respectfully recommend that your Honorable Board should arrange for a full and satisfactory rest of *all* parts of this machinery, the same to be made by a Commission of scientific gentlemen selected by your Board, and that this Commission be instructed to ascertain by actual experiment the capacity of the reciprocating and the rotary pumps, separately and when working together, and to make such other tests as may be necessary, in order to determine the power and efficiency of the machinery for domestic and for fire purposes.

Yours very respectfully,
W. H. PURDY, Supt. Water Works.

CIVIL ENGINEERS' CLUB OF THE NORTHWEST.—This Club held its first meeting after the summer vacation, last night (14th inst.), at which Geo. H. Frost and Chas. J. Moore were elected members, and a paper was read by H. W. S. Cleveland, on the use of boulevards as a means of preventing the spread of fires in Cities,. We have not space in this number to report the paper in full.

THE MINER'S INCH.

Considerable disparity exists in various parts of this country, between measurements known by the same name. Measures of length, weight and quantity, vary according to the portion of the United States in which they are situated.

As plainly shewn in the article on "City Surveying in Chicago," in the present number, even the so-called *standards* of length vary in different localities; all of them ought, however, to be based upon those established by the U. S. Coast Survey.

In weight there is the same discrepancy noticed between the "long" ton of 2,240 lbs., and the "short" ton of 2000 lbs., the bushels of 72, 80, and 90 lbs. respectively, and the Nova Scotia Chaldron of 33 bushels, and the Boston retail chaldron of 2,500 or 2,700 lbs.

Most of our Western readers will know what is meant by "a miner's inch;" but for the information of those in the East, we will explain that it is the unit of measurement generally adopted in the Territories as the basis upon which miners pay for the water supplied to them, for "washing" and "concentrating" operations, by the different ditch companies.

In the older countries on the Continent of Europe and elsewhere, there are good and sufficient reasons for units of measurements varying in adjacent States. Difference of race, language, government, and system of laws, all explain the different values given to the *oncia* or "inch" adopted as the unit of measurement in Irrigation works in Lombardy, Piedmont and other Italian States, and the "*palmo*" in Spain, &c.

But in our own country no reason exists for variation in such a unit of measurement as the "the miner's inch," yet such variation exists as we show below, a variation which is only explicable by the perfect freedom of action which individuals and corporations enjoy in this "sweet land of liberty," and which leads them in running their own works, to take too little notice of the way in which their neighbor is running his.

As we have before urged in this journal, such matters of *national* importance as the variation of measurements of the same name in various portions of this Country, should be well agitated with a view to their ultimate unification; one of the objects of this journal is to aid in effecting a uniform system of measurements throughout the country.

The miner's inch varies according to the pressure of water used, and the height of the aperture. Usually the head is six inches and the aparture a horizontal slit 1" high × 24" long, which fully open, discharges twenty-four "miners' inches," a lesser discharge being obtained by closing the aperture in the direction of its length. In this case one miner's inch would give a discharge of 1.576 cub. feet per minute; that would be the quantity of water which would flow through an aperture 1" square, under a head of six inches. The Eureka Lake and Canal Company, of California deliver water through an aperture two inches high, and with a head of six inches, and as each inch of length of aperture is considered a miner's inch, in this case

it follows that the miner's inch here gives a discharge of 3.001 cub. ft. per minute; this being the quantity which would flow through an aperture 2″ high × 1″ long, under a six inches head.

Tabulating these and the measurement of some other Californian Ditches we obtain the following:

VALUE OF A "MINER'S INCH" AS DELIVERED BY DIFFERENT DITCHES.

NAME OF THE DITCH COMPANY.	Size of Orifice in inches.		Head of water above the Orifice in inches.	Discharge in cubic feet per minute.
	Height	Breadth		
Usual "Miners' Inch.....	1	1	5	1.579
Eureka Lake and Canal Co.....	2	1	4	3.001
Excelsior Ditch, and Sears' Ditch.....	1	1	9.5	2.124
Mokelume Hill & Campo Leno Ditch..	1	1	3	1.258
Phœnix Ditch Co.....	3	1	4	4.731
Gold Hill Ditch, El Dorado Co., Cal..	2	1	2	2.33
Another El Dorado Co. Ditch.....	3	1	none.	2.23
Smartsville Hydraulic Mining Co.....	4	1	5	1.776

A "Head of Water" is 500 inches daily for 10 hours, and is the quantity required for a first-class hydraulic operation.

The minimum discharge for an inch is according to the above table 1.258 cub. ft., and the maximum 4.731 cub. ft., while the module or orifice and head commonly employed gives 1.579 cub. ft. discharge, a quantity not much above the minimum inch recorded.

The names of the companies, size of orifices, and heads of water are given on the authority of Professor W. P. Blake, of California, and the discharges have been calculated according to the following formula:

$D = 482\sqrt{h} \times A \times K$, in which D = Discharge in cub. feet per minute, h = Head of water in feet, measured from *centre* of orifice, A = Area of Orifice in square feet, K = a co-efficient calculated from the known discharge of the usual "miner's inch," and found to be = .696.

IMPORTANT LAND DECISION.

The decision of the Supreme Court of the Territory of Colorado, which we reprint below, from the *Colorado Chieftain* of Pueblo, C. T., has a very important bearing upon very large landed interests in the State of California, and the Territories of Colorado and New Mexico.

In order to place the case plainly before our readers, it may be as well to recapitulate, that at the close of the last Mexican war, a large tract of country was ceded to the United States Government, comprising a considerable portion of California, all Arizona and New Mexico, and that portion of Colorado lying south of the Arkansas River which was then included in the Mexican province of New Mexico. This treaty, known as that of Guadalupe Hidalgo, signed Feb. 2nd, 1848, and the Gadsden purchase also provided that all rights or titles to land held by Mexican citizens residing in the ceded provinces, should be respected and confirmed by the U. S. Government. Congress accordingly passed, twenty years subsequent, "An act to "to confirm certain private land claims, lying in the Ter- "ritories of Colorado and New Mexico," including also, we think, those in California, and among those grants *generally* confirmed was that of the Sangre de Cristo, lying in the San Luis Park in the Territories of Colorado and New Mexico.

As the Great West became better known, the attention of certain capitalists and others was directed to the immense tracts of valuable grazing, agricultural and mineral lands in the above named Territories. The first obstacle, however, that they encountered in negotiating for the purchase of these lands was the difficulty and expense in obtaining a perfect United States title.

Congress, it is true, had confirmed these grants *generally*, but not *specifically*, nor would it interfere to alter the laws of the United States in this particular instance, which laws provide that a United States Government survey of the land claimed shall be made by the Surveyor General of the District or his Deputy, before a Patent or United States Title is issued to the applicant and that said applicant shall deposit a sum sufficient to cover the expense of said survey, before the survey is commenced.

To go to all this trouble and expense, however, did not of course, suit the purposes of those who were negotiating for the purchase of some of these grants, merely to sell them again to Joint Stock Companies to be formed for their settlement by immigration and ultimate development.

Several of these grants then were purchased from the original grantees or their heirs and re-sold to American and Foreign capitalists, chiefly the latter, who formed companies to settle and develope the same. The United States Freehold Land and Emigration Co. is one of these companies, incorporated by charter approved July 8th, 1870, with a capital of $2,500,000 in shares of $100 each, the stated object of the company being "to promote and "encourage immigration to, and establish settlements on "the Lands of said Company, in the San Luis Park," in "the Territories of Colorado and New Mexico; to con- "struct all roads, railroads, telegraph lines, &c.," and erect any kind of manufactures which might be necessary for the development of their property.

This property consisted of the "Costilla Estate," being the southern portion (about one half), of the Sangre-de-Cristo grant, situated in the San Luis Park, and lying partly in the Territory of Colorado, and partly in that of New Mexico; its boundaries being the Rio Grande on the west, the Rio Culebra (a tributary of the Rio Grande), on the north, the summit line of the Sierra on the east, and on the south, a line drawn from the certain point on the Rio Grande to a point on the summit of the said Sierra. As determined by a survey of the entire Estate, made by one of the editors of this journal, the area of the same amounted to 480,000 acres, of which about equal portions lay in the two Territories, and about one-half of the whole lay in the mountains, being useful only for timber and such valuable minerals as might be found upon careful prospecting.

In the spring of '71, the Company sent out its Managing Director and Assistant Manager to commence the development of the Estate. But on arriving it was found that the opposition of and possession by Mexican settlers rendered this

development impossible until some compromise had been effected with them.

There were about 1500 Mexicans living in various "plazas" or towns on the Estate, a large portion, some 700, lived in the town of La Costilla, situated on the river of that name, and through which the 37th parallel of latitude passed, dividing the town into two portions, one in each Territory.

The Mexicans had, of course, settled all along the river sides, and cultivated, by means of their rude but effective irrigation systems, the greater part of the river bottoms.

Of the 700 living in the town of La Costilla, about 15 only had any written titles from the original grantee, though many of them had had verbal promises of such from him, and even the lands stated to be conveyed by those deeds were not correctly located according to their descriptions. The year '71 passed over without any compromise being effected between the Company and the Mexicans, but the feelings of the latter had become aroused to such an extent, that when the writer, who was at that time engineer to the Company, commenced in February, '72, to make a survey of their holdings, with a view to making a final adjustment of the difference between the Company and the Mexicans, the latter came on the ground in force and stopped the survey. Matters continued *in statu quo* until the ensuing spring, when the newly elected Board of Trustees decided to suspend all operations until an adjustment of the Mexican difficulties had been made or was in course of satisfactory progress.

This adjustment, we are glad to say, is now in progress, the Company offering liberal terms to those of the Mexicans who will apply for titles to the lands held by them, and the Company's engineer is now engaged in surveying the estate into sections, quarter sections, &c., &c., preparatory to inviting a large immigration.

The Sangre-de-Cristo grant was originally made to two grantees, and as by the Mexican law a grant of land could not cover more than 11 square leagues to each grantee, the grantees of the Sangre-de-Cristo grant were only entitled to 22 square leagues; a spanish square league being= 11,937 square miles, 22 of such leagues would thus=262,614 square miles or 168,072.960 acres. As the whole Estate amounted to some half million of acres, the Mexican settlers asserted that the grant was an invalid if not an illegal one, and this same view was taken presumably by certain English and German settlers who came there since the transfer of the property to the U. S. F. L. & E. Co., in 1870, and took up their land without title from said Company.

Against one of these latter, a suit of ejectment was instituted in the District Court, and won by the Company.

On appealing to the Supreme Court of the Territory, the decision below was given, and it is highly probable that the Supreme Court of the United States will, when appealed, to confirm the decision of the Territorial Courts, thereby settling forever a point of vital interest as regards the settlement and development of a large portion of the finest lands in the West. This will be better understood on referring to the last Report of the Surveyor General of New Mexico, in which it is stated that one-eighth of the whole Territory consists of those private land claims; as the whole Territory consists of 77,563,640 acres or 121,201 square miles, this 9,000,000 or 10,000,000 acres is no inconsiderable amount.

"The opinion of Judge Belford has just been filed in the clerk's office of the supreme court of this territory in the case of John G. Tameling, appelant, *versus* the United States Freehold Land and Emigration Company, appellee. According to it, the agreed statement of facts filed in this cause in the court below, and in pursuance to which judgment was tendered, presented but a single question for decision: Was private land claim No. 14, usually known as the Sangre de Cristo grant, a valid grant as to all the land contained within the exterior boundaries of said grant as shown by the judicial certificate of possession, and the report of the Surveyor General to the Commissioner of the general land office, or is the act of Congress opproved June 21, 1860, entitled 'An act to confirm certain private land claims in the territory of New Mexico" to be construed as only a confirmation of twenty-two square leagues, eleven square leagues to each of the original grantees? The record shows that the premises in controversy are situated within the exterior boundaries of a certain tract of land known as the "Costilla Estate,' which estate constitutes a part and was carved out of the Sangre de Cristo grant. The court below held that the plaintiff was entitled to the premises in dispute in fee, and that it have a writ of possession therefor. From this finding the defendant prayed an appeal. The assignment of error presents the same points raised in the court below.

The court held that the act of confirmation operated as a quit claim deed to all the premises included within the natural boundaries of the original grant, and that when Congress confirms a grant by number it must be regarded *ex necessitate* as a conveying a title to every acre within the grant. The court reviews at considerable length the Mexican and Spanish laws on the subject of grants, and concluded that even if the grant was originally void on the ground that the provincial governor of New Mexico exceeded his authority, still it would have been entirely competent for the Mexican Congress to have ratified the unauthorized act of the governor by subsequent legislation, and whatever power Mexico had in the premises, the United States succeeded to by reason of the treaty of cession of Guadalupe Hidalgo, and the act of confirmation must be regarded as a ratification of the act of the Mexican governor. The court, therefore, holds that the grant is a valid one, and that the successors of the original grantees are invested with a complete and indefensible title. A writ of error has been sued out from this decision to the United States supreme court.

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